STATE OF ALASKA DOT&PF

STATEWIDE MATERIAL SITE INVENTORY

STATUS & INSPECTION REPORTS

NORTHERN REGION
VOLUME 1

FEDERAL AID HIGHWAY SYSTEM
PRIMARY ROUTE NO. 62 - ALASKA HIGHWAY
CANADIAN BORDER (MP 1222)
TO DELTA JUNCTION (MP 1422)

FEDERAL PROJECT NO. STP-000S(530)
AKSAS PROJECT NO. 76174

ALASKA DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
5800 East Tudor Road
Anchorage, Alaska 99507-1286

April, 2008

STATEWIDE MATERIAL SITE INVENTORY

LIMITATIONS

The discussions of material site conditions presented in these reports has been based on the pertinent information listed herein and are intended to be used for planning purposes only. The information contained should be verified prior to use for design or construction purposes. To be sure of comprehensiveness, please check with State of Alaska DOT&PF materials staff for updated information. Every reasonable effort has been made to assure the accuracy of the maps and associated data. However, the State of Alaska DOT&PF makes no warranty, representation or guaranty as to the content, sequence, accuracy, timeliness or completeness of any of the data provided herein. The State of Alaska DOT&PF explicitly disclaims any representations and warranties, including, without limitation, the implied warranties of merchantability and fitness for a particular purpose. The State of Alaska shall assume no liability for any errors, omissions, or inaccuracies in the information provided regardless of how caused. The State of Alaska DOT&PF shall assume no liability for any decisions made or actions taken or not taken by the user of the applications in reliance upon any information or data furnished hereunder.

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ALASKA HIGHWAY
CANADIAN BORDER (MP 1222) TO DELTA JUNCTION (MP 1422)

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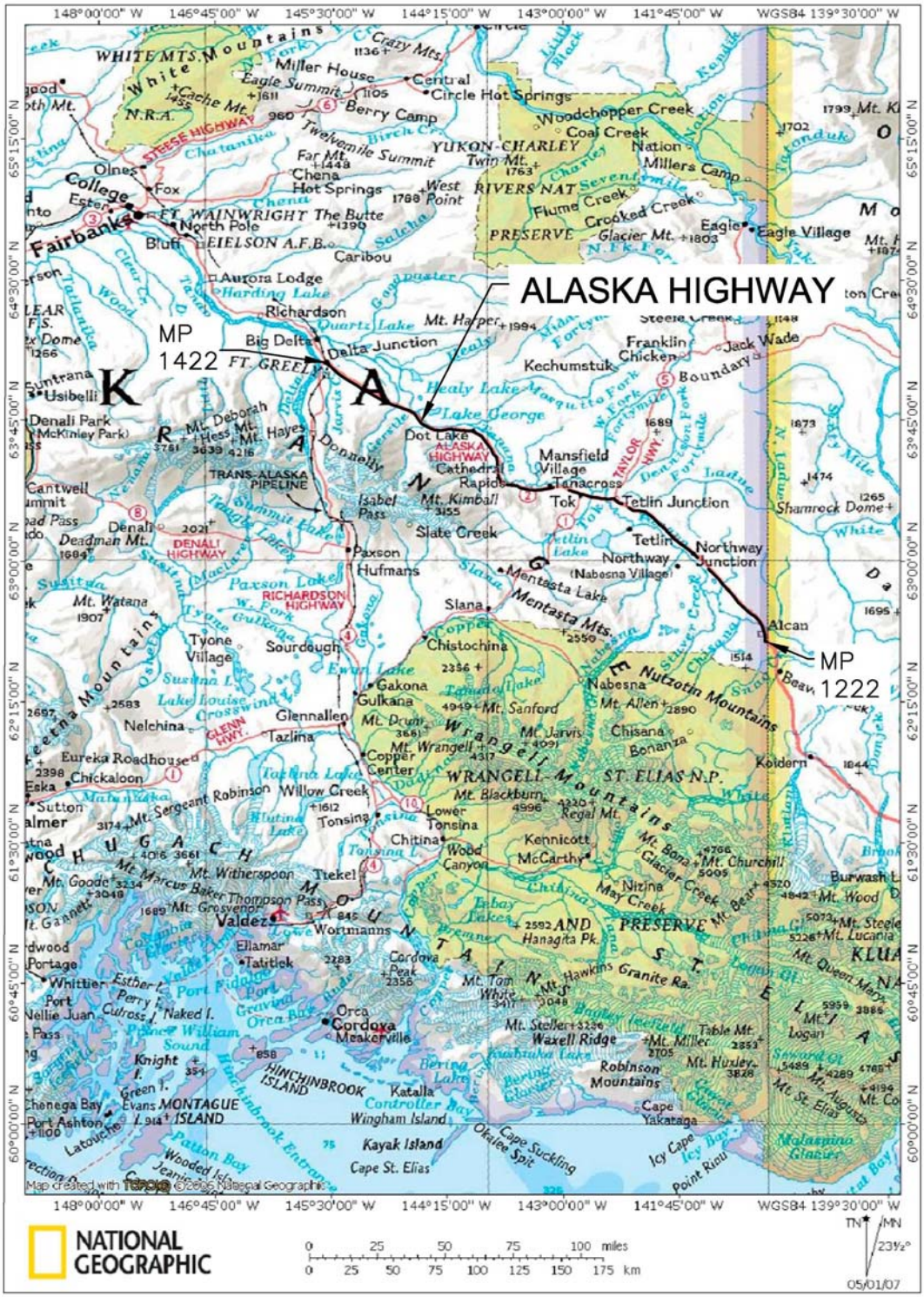

1.0 MATERIAL SITE NUMBERING

Alaska Department of Transportation and Public Facilities (DOT&PF) material site numbers are generally assigned using the following format.

For primary or interstate route system coding, i.e. 62-1-001-5:

- The first two digits represent the Primary Federal Aid Route Number, for the Alaska Highway this number is 62.

- The third digit represents the control section of the route. The Alaska Highway is divided into four sections as follows:

    1. Canadian Border to Tetlin Junction
    2. Tetlin Junction to the Johnson River
    3. Johnson River to Shaw Creek
    4. Shaw Creek to Fairbanks

    These sections appear to have varied over the years and there is some overlap between Sections 2 and 3.

- The 4^{th}, 5^{th} and 6^{th} digits are the assigned site number.

- The last digit is the region in which the site is located. Along the Alaska Highway both 2 and 5 are used due to past changes in the region boundaries.

The Alaska Highway route number (62) is used for material sites along the Alaska Highway from the Canadian Border to Delta Junction and along the Richardson Highway between Delta Junction and Fairbanks.

2.0 GEOLOGIC SETTING

The following information is general in nature and is intended to provide those who are unfamiliar with the area with a general description of the geology, and how it relates to material sites. This information is not intended to be complete. More detailed investigations should be performed before decisions are made on individual material sites.

2.1 Location

The inventory area lies along the Alaska Highway corridor between Mileposts 1222 at the Canadian border and 1422 at Delta Junction, a distance of approximately 200 miles. Two small cities, Tok (MP 1314) and Delta Junction (MP 1422) and several native settlements including Dot Lake, Tanacross, Tetlin and Northway lie along the highway corridor. The Alaska Highway was built during World War II to transport military supplies to Alaska and was originally constructed as a narrow,

winding gravel road. After the war, the highway was extensively realigned starting in the 1950s and continuing through the present day. Sections of the abandoned road can be observed on aerial photographs and maps. The highway alignment shown on the U. S. Geological Survey topographic maps show the location of the highway at the time the map was prepared. However, in many places the road has since been realigned and the current alignment is not reflected on these maps.

2.2 General Geology

This portion of the Alaska Highway is located in the upper Tanana Valley, between the relatively young and more rugged Alaska Range and the older, more subdued hills to the north within the Yukon Tanana Uplands. The Chisana and Nabesna Rivers join to form the Tanana River near Northway Junction. The Tanana River then flows west along the north side of the valley, having been pushed north by the large alluvial fans formed along the north side of the Alaska Range.

Unconsolidated sources of material along the Alaska Highway consist of glacial, fluvial, and eolian deposits. Extensive fine-grained fluvial deposits occur in the Tanana and Chisana River floodplains between the Canadian Border and Tok. Large dune fields composed of silt and fine to medium sand are found between the Canadian Border and the Tanana River near Milepost 1303. Peat deposits are interbedded with the fine-grained floodplain and eolian deposits. Glacial deposits occur south of the Tanana River and consist of glacial till and outwash deposited during several glacial episodes. Large alluvial fans are found along the north side of the Alaska Range and include the Tok Fan and the large outwash fan between Delta Junction and the Gerstle River. Smaller alluvial fans are common between the Gerstle River and the Tok Fan.

Between the Canadian Border and Tok, the Tanana and Chisana Rivers flow through meandering channels in wide floodplains. Tributaries such as Gardiner Creek and Scottie Creek are slow-flowing streams meandering through swales. Between Tok and Delta Junction, numerous rivers and streams cross the alignment flowing from the Alaska Range to the Tanana River. These streams are glacially fed and are subject to high flow during both warm summer weather and periods of high rainfall. Extensive icing is a common occurrence on the braided rivers. Therefore floodplains may be left ice-covered into late summer. Many of the rivers and streams are aggrading, i.e. they carry large bed loads. Thus, mined areas in the larger rivers may be completely restored within a few years. Steep mountain streambeds may be infilled with material causing their channels to shift and dredging operations are often required to keep these streams within their designated drainage structure. Many of the streams and small rivers are losing systems (i.e. the groundwater table is lower than the river level whereby water flows from the river directly to the groundwater table).

The Alaska Highway lies along the north side of the Alaska Range. Therefore permafrost may be encountered anywhere along the alignment. Generally, permafrost ranges from discontinuous to sporadic or occurs in isolated masses. Where permafrost occurs in fine-grained or organic soils, it may be ice-rich.

Between the Canadian Border and Tok, the alignment crosses low hills composed of granitic Cretaceous rocks of the Gardiner Creek Pluton and Precambrian and Paleozoic schist and gneiss bedrock. The granitic rocks intrude the schist and gneiss and consist of quartz monzonites and

diorites that often weather to sand (grüss). Weathering penetrates to depths of more than 100 feet along joint planes, often creating a structure of hard core stones (large boulders) floating in a matrix of sand. Greenstone dikes were encountered at Paradise Hill near MP 1238 and in the Island Lake Quarry at MP 1231.5. There are no DOT&PF material sources containing alluvial gravel east of the Tanana River at MP 1303. All of the sources lying between MP 1222 and 1303 are in bedrock or the fine-grained eolian sand, or both.

Between Tok and Delta Junction, the Alaska Highway crosses schist and granite bedrock. Due to the presence of significant quantities of sand and gravel, there is only one bedrock source along this part of the alignment, at the Gerstle River (MS 62-3-075-2). This is the only site that has produced significant quantities of large riprap along this section of the Alaska Highway.

2.3 Canadian Border to Gardiner Creek (MP 1222 to 1247)

Between the Canadian Border and Gardiner Creek, the highway lies in the Chisana River Valley. The Tetlin Wildlife Refuge lies to the south of the Alaska Highway and parts of several sites appear to lie within the refuge (MS 62-2-001-5, MS 62-2-024, MS 62-2-005 and MS 62-2-021-5). It should be noted that the northern refuge boundary was defined as a line 300 feet south of the highway centerline based on the location of the Alaska Highway shown on a map entitled “Tetlin National Wildlife Refuge” (1:250,000 scale) published in 1980. Thus, MS 62-2-025-5 is not in the refuge even though it lies to the south of the present (post 1980) highway alignment. The active sites not in the wildlife refuge reportedly lie on State of Alaska Lands.

There are stable (vegetated) dune fields throughout the area. The valley floor is overlain with silt and sand deposited by wind or fluvial action. DOT&PF has previously utilized numerous small sites within the dune complex. However, all but MS 62-2-021-5 is closed at this time. There are also significant peat deposits on and interlayered between the silt and sand deposits, particularly along Gardiner and Scottie Creeks. The soils are perennially frozen and often ice-rich in the lower lying areas.

Material source along this section of the highway primarily contain weathered schist found in the hills and ridges along the north side of the river. Generally, this schist is soft and degrades rapidly. Therefore it is usable only as common borrow (Type C material). The schist can also become difficult to compact if it becomes wet. Ice-rich permafrost may be found at depths of up to 20 feet or more in the schist.

Two sites, MS 62-2-007-5 (Paradise Hill Quarry) and MS 62-1-024-5 (Island Lake Quarry), contain harder rock in the form of small dikes or sills of greenstone. However, the extent of those dikes and sills may be limited. Mining of these dikes generally requires selective excavation. There is also a large greenstone unit on Airs Hill located within the Tetlin Wildlife Refuge about 3 miles south of the Border Station, but it would require construction of a three to four mile long access road to reach the site.

The Paradise Hill and Island Lake Quarries are the only sites that have a record of producing crushed aggregates that meet current standards. Aggregates were usually produced from the greenstone. Crushed aggregates have been produced from the schist, but the material likely did

not meet current degradation specifications. The schist unit is highly variable with portions of a pit meeting standards while other portions do not meet specifications. Based on information in the material sites files, it appears that in general the unit does not produce aggregates that will meet specifications. It may be possible to produce select material Types A and B from some of the schist, however, breakdown of the material during handling and compaction may create excess fines.

2.4 Gardiner Creek to Tok River, Including Northway (MP 1247 to 1306)

Between Mileposts 1247 and 1306 the highway lies along a series of low hills on the north side of the Tanana River. These hills are composed of granitic rocks, schist and quartzite. The valley floor is overlain with silt and sand deposited by wind or fluvial action. Dune fields occur throughout the area. Significant peat deposits occur both on and interlayered between the silt and sand deposits. The soils are perennially frozen and often ice-rich in lower lying areas. Some of the sand has been known to have low enough moisture contents to be used in fills. Most of the land along the highway between Gardiner Creek and the Tok River was owned by native corporations. There were a few parcels of State or State-selected land in this area. All of DOT&PF's material sites in this area consisted of small rights-of-way overlying lands owned by the native corporations. There were scattered parcels of private land (including Native Allotments) along this part of the alignment with the largest concentration near Northway Junction.

The granitic rocks are composed primarily of diorite and monzonite. The rock tends to weather rapidly to sand (grüss). In the past, sites in this area have been mined by scraping off the sand until hard rock is reached and then waiting a few years and repeating the process. In many places weathering has penetrated to depths of greater than 100 feet within the joint systems. This creates a condition where large, less weathered core stones (boulders) float in a sand matrix, making handling of the material very difficult. In other places the rock has completely degraded to clay. Generally, cut faces in the granitic rocks are covered with rust brown sand. Bedrock quarries in the granitic rocks generally produce a degradable rock that makes adequate common borrow and Select A and B materials with selective mining techniques. Harder zones in the granitic rocks have degradation and Los Angeles Abrasion test results which indicate that the rock may produce crushed aggregates that meet current standards.

Between Mileposts 1267 and 1277.5, the highway crosses through schist, gneiss and quartzite bedrock units. The schist and gneiss are intruded by various granitic and other felsic (light colored) rocks. A good example of this can be found in the road cut across from the pullout at Milepost 1274. Highway cuts in these rocks were generally rougher and stood steeper than those in the granitic rocks. It may be possible to procure aggregates from the quartzite and some of the gneisses. However, selective mining and processing will likely be required.

Small basalt stocks are also found near Tetlin Junction at about MP 1302. There were no DOT&PF sites in the basalt and little is known of their engineering properties.

2.5 Tok Fan (MP 1306 to 1329.2)

The Tok Fan is a large glacial outwash fan extending north from the Alaska Range into the Tanana River Valley. The Tanana River has apparently been "pushed" to the north side of the valley by the fan. In general, the fan has a gently sloping surface with limited relief. It slopes gently north and to the east and west from the City of Tok. Land ownership on the Tok Fan is varied with numerous small private parcels and larger State and Native-owned parcels.

The Tok fan is primarily composed of sand and gravel with cobbles and boulders overlain by silt deposits. In places the gravels are cemented, notably near the U. S. Coast Guard Loran Station on the east side of the Tok River. Between MP 1306 and approximately MP 1312 east of Tok, the silt depth varies and can be deep (greater than 3 feet). West of MP 1312, to about MP 1326, the silts are generally shallow (less than 3 feet deep) along the highway. Deeper silts and thick peat layers are encountered along the highway between MP 1326 and MP 1329. Isolated pockets or sporadic permafrost may occur throughout the fan. Where permafrost occurs, the depth to the top of permafrost has been observed to range from near surface to about 40 feet.

Many of the streams and rivers crossing the coarse, highly permeable gravels in the fan are "losing" and do not reach the Tanana River. This includes the largest of these rivers, the Tok River which typically infiltrates the groundwater table during most of the year before it reaches the Tanana. The groundwater table adjacent to the Tok River has been encountered as deep as 40 feet below the bank. Groundwater tables in the Tok area reportedly range from 70 to 100 feet in depth, although shallower perched water tables may be encountered.

Degradation values in the alluvial and glaciofluvial sands and gravels were generally greater than 50 and the Los Angeles Abrasion loss less than 30 percent. These test results indicate that material for producing crushed aggregates is available on this fan.

2.6 Yerrick Creek and Cathedral Rapids Area (MP 1329.2 to 1345.3)

Between MP 1329.2 and MP 1345.3, the highway crosses a series of alluvial fans interspersed with glacial moraines. All of the existing material sources are located on the alluvial fan deposits. The fan material typically consists of coarse gravel with numerous large boulders interspersed with silty layers. The glacial tills are generally silty and less suitable for construction uses than the alluvial gravels. Small terraces of the Tanana River are found north of Sheep Creek. Lands through this area are primarily owned by the State of Alaska and Native Corporations. Several small DOT&PF sites consist of rights-of-way on Native Corporation lands, but the two larger sites (MS 62-2-176-2 and MS 62-2-177-2) are on State Land. Material Site 62-2-176-2 on the Yerrick Creek Fan is the principal site in this area.

The Yerrick Creek fan (MP 1332 to 1337) is the largest of these alluvial fans and the area around Material Site 62-2-176-2 may provide significant quantities of gravel. The area between Cathedral Rapids No. 1 and Sheep Creek is crossed by alluvial fan deposits composed of narrow channel deposits interspersed with layers of finer-grained material. Terrace deposits consist of sandy gravel overlain by one to two feet of silt and organics.

Overburden consists of both windblown and alluvial silts and may vary considerably in depth. There are several large creeks flowing across these fans: Cathedral Rapids Creek Nos. 1 and 2, Sheep Creek and Yerrick Creek. There are also numerous smaller creeks, many of which are ephemeral, flowing only at certain times of the year, or even day. The larger creeks may be subject to severe flooding. Generally, the groundwater is not encountered at depths that would effect mining operations (<30 feet). Discontinuous permafrost is encountered in the alluvial fan deposits.

There were six DOT&PF material sites in this section. Laboratory testing indicated that the Los Angeles Abrasion loss in the alluvial and glaciofluvial sands and gravels was generally less than 45 percent. Degradation values obtained from samples taken from these pits were variable with results ranging from 25 (MS 62-2-015-5) to 79 (MS 62-2-014-5). These test results indicate that an optimum location for obtaining consistent material to produce crushed aggregates may be on the Yerrick Creek Fan, particularly in MS 62-2-176-2 (Yerrick Creek Pit). It appeared that it may be difficult to produce crushed aggregates in three other sites (MS 62-2-013-5, MS 62-2-015-5 and MS 62-2-177-2), due to low degradation values. Variable silt contents typical of alluvial fan deposits may necessitate utilizing selective mining techniques.

2.7 Robertson River Area (MP 1345.3 to 1358.5)

With the exception of the Robertson River area, the soils within this segment generally consist of glacial moraine deposits east of MP 1352 and alluvial fan deposits to the west. Extensive floodplain deposits are found on the Robertson River floodplain at MP 1347.5. What appeared to be glaciofluvial terrace deposits are located along the south side of the Robertson River. Lands through this area are primarily owned by the State of Alaska and Native Corporations. Several small DOT&PF sites consist of rights-of-way on Native Corporation lands, but the two larger sites (MS 62-2-172-2 and MS 62-2-174-2) are reportedly on State Land.

The Robertson River is an aggrading river with large a bed load. Therefore material sources on the river floodplain are “replenished” over time. The floodplain can become covered by thick ice in the winter and the ice may not completely thaw before August. The floodplain is braided with regularly shifting channels. River banks are high and steep. Therefore access to various parts of the floodplain can become problematic.

Material sites in this area generally contain coarse sandy gravel with cobbles and boulders. The primary sources of material along this section of highway are the seven material sites, all lying on the fluvial deposits. Sites in the glacial till deposits have been closed. There are also granite and schist bedrock outcrops west of the Robertson River. Bedrock sources have apparently not been developed due to the presence of suitable gravels sources nearby. The gravel likely will also produce superior material to the bedrock sources.

Generally, overburden consists of a thin layer of eolian silt overlying the alluvial fan gravels. There are also areas of deep silt and peat. Permafrost is generally present under the moraines, and absent near the surface in alluvial gravel deposits.

Degradation values for the alluvial gravels were generally greater than 50 and the Los Angeles Abrasion loss less then 30 percent. These test results indicate that material for producing crushed aggregates may be available in this area.

2.8 Dot Lake Area (MP 1358.5 to 1378.2)

Between MP 1358.5 (Chief Creek) and MP 1378.2 the highway alignment lies along the south side of the Tanana River, adjacent to a series of low bedrock hills and ridges. The soils apparently consist of alluvial and glaciofluvial sand and gravel with cobbles and boulders. The gravels appear to be coarser west of MS 62-2-068 at MP 1370 with more and larger plus 3-inch material. All of the existing material sites in this area are located in the alluvial or glaciofluvial sands and gravels. The bedrock underlying the hills consists of granitic rocks, generally composed of monzonite or granodiorite. The granitic rock is reportedly highly weathered.

Generally, the sand and gravel units are overlain by a thin layer of silt. However, depths up to five feet of silt have been reported and areas with deeper silt and peat deposits can also be found along the alignment. Permafrost is discontinuous to sporadic. Near Dot Lake, groundwater tables may be encountered within 5 feet of the surface.

The degradation values in the alluvial and glaciofluvial gravel are generally greater than 45 and the Los Angeles Abrasion loss is less than 30 percent. These test results indicate that material for producing crushed aggregates may be available in this area.

2.9 Johnson and Gerstle River Areas (MP 1378.2 to 1393.2)

Between MP 1378.2 (Dry Creek) and MP 1393.2 (Gerstle River), the Alaska Highway crosses glacial moraine and alluvial fan deposits. Glacial moraine deposits with high silt contents occur between MP 1381 and MP 1386. The alignment then crosses a large alluvial fan of the Little Gerstle River. The materials consisted of sand and gravel overlain by varying depths of silt. There are material sources on gravel bars in both the Johnson and Gerstle River floodplains.

The only existing DOT&PF bedrock source between Tok and Delta Junction is a granite knob east of the Gerstle River (MS 62-3-075-2). This quarry is the only existing source of riprap for many miles.

Degradation values for the alluvial and glaciofluvial gravel are generally greater than 50 and the Los Angeles Abrasion loss is less than 30 percent. These test results indicate that material for producing crushed aggregates may be available in this area.

2.10 Delta Outwash Fan (MP 1393.2 to 1413.5)

Between MP 1393.2 and MP 1413.5, the highway crosses an outwash fan that slopes gently to the north until it reaches the Tanana River. Materials consist of sand and coarse gravel overlain by varying depths of silt. Excellent material sites can be located almost anywhere on this fan. Minimizing overburden depth and permafrost are the usual criteria for site locations.

There are numerous small creeks that flow across this outwash plain. Many of them are ephemeral, flowing only at certain times of day or year. Along the Alaska Highway, groundwater is not generally encountered at depths that would affect mining operations (<50 feet). Permafrost ranges from sporadic to occurring in isolated pockets. Frozen soils range from well bonded to very friable, depending on moisture content and ground temperature.

Degradation values for the alluvial and glaciofluvial gravel are generally greater than 50 and the Los Angeles Abrasion loss is less than 35 percent. These test results indicate that material for producing crushed aggregates is available in this area.

2.11 Clearwater Road to Delta Junction (MP 1413.5 to 1422)

Between MP 1413.5 and about MP 1416, the highway crosses glacial moraine deposits and from about MP 1416 to MP 1422, the alignment crosses a portion of the Jarvis Creek alluvial fan. The present channel of Jarvis Creek crosses the Richardson Highway south of Delta Junction. However, older abandoned channels of Jarvis Creek also cross the Alaska Highway. Peat bogs have formed along the eastern edge of the fan along the Alaska Highway. DOT&PF has only one remaining site (MS 62-3-079-2) along the highway in this area and its status is unclear.

3.0 LAND USE PLANNING – TANANA BASIN AREA PLAN

State lands along the Alaska Highway are being managed by the State of Alaska Department of Natural Resources (DNR) under the Tanana Basin Area Plan adopted in 1991 (Subregions 6 and 7). The complete plan is available on the internet at the following address:

http://www.dnr.state.ak.us/mlw/planning/areaplans/tanana/index.cfm

The introduction to the plan states that the "The plan designates the uses that will occur on state lands within the Tanana Basin. It shows areas to be sold for private use and area to be retained in state ownership. It does not direct land uses for private, borough, or federal land, nor does it direct land uses for areas already legislatively designated for specific purposes, such as parks or wildlife refuges."

The section on Materials in Chapter 2: Goals of the Plan, list one of the goals of the plan as "Maintain in state ownership and make available to public and private users sufficient, suitably located material sites to economically meet the area's long term need for materials.

The following are the Management Guidelines:

> "**A. Preferred Material Sites.** When responding to a request for a material sale or identifying a source for material, the highest priority should be to use existing material sources. Using materials from wetlands and lakes should be avoided unless no feasible alternative exists. Sales or permits for sand, silt, or gravel extraction will not be permitted in fish spawning area identified by DF&G unless extraction would enhance the site for rearing and DF&G determines that the activity is compatible with fish habitat values.
>
> **B. Material Sites.** To minimize the construction and maintenance cost of transportation facilities, material sites should be located as near as is feasible to the site where the material will be used.
>
> Design of projects will be on a case by case basis in consultation with other agencies. The following are general guidelines for extracting materials:
>
> > **1. Material Sources.** Consideration should be given to all potential material sources. Location and design of sites should take into account factors such as scenic quality, transportation to the site, and effects to fish and wildlife habitat.
> >
> > **2. River Size and Recharge Rates.** Selection of gravel sites in floodplains should take into account the volume of gravel available from various stream types. Generally, the largest river feasible, or the one with the largest gravel recharge rates should be chose.

3. Reclamation. Reclamation of material sites will be accomplished consistent with AS 17.15.

4. Extraction from Active Channels. When extracting gravel in active or inactive floodplains, maintain buffers that will minimize sedimentation and will contain active channels in their original locations and configurations in the short term.

C. Maintaining Other Uses and Resources when Siting and Operating Material Sites. Before allowing the extraction of materials, the manager will ensure that the requirements of the permit or lease give adequate protection to other important resources and uses including existing water rights, water resource quantity and quality, navigation, fish and wildlife habitat and harvest, commercial forest resources, recreation resources and opportunities, historic and archaeological resources, adjacent land uses, and access to public or private lands. Disposal of materials should be consistent with the applicable management intent statement and management guidelines of the plan.

The manager should also determine if other existing material sites can be vacated and rehabilitated as a result of opening a new material site.

D. Screening and Rehabilitation. Material sites should be screened from roads, residential areas, recreational areas, and other areas of significant human use. Sufficient land should be allocated to the material site to allow for such screening. Where appropriate, rehabilitation of material sites will be required. For additional guidelines affecting material extraction see policies under the subsurface resources section.

E. Other Guidelines Affecting Materials. Other guidelines may affect materials. See in particular the following sections of this chapter:

- Fish and Wildlife Habitat and Harvest
- Settlement
- Subsurface Resources
- Transportation”

4.0 RELEVENT PUBLICATIONS

The following is a list of publications that may be useful for understanding the geology and material sources along the Alaska Highway Corridor between the Canadian Border and Delta Junction.

Carrara, P.E., 2004, "Surficial geologic map of the Tanacross B-5 quadrangle east-central Alaska", U.S. Geological Survey Scientific Investigations Map I-2856.

Carrara, P.E., 2004, Surficial geologic map of the Tanacross B-6 quadrangle, east-central Alaska: U.S. Geological Survey Scientific Investigations Map I-2850.

Carter, L.D., and Galloway, J.P., 1978, Preliminary engineering geologic maps of the proposed natural gas pipeline route in the Tanana River valley, Alaska: U.S. Geological Survey Open-File Report 78-794, 26 p., 3 sheets, scale 1:125,000.

Cobb, E.H., 1977, comp., "Generalized geologic map of the eastern part of southern Alaska", U.S. Geological Survey Open-File Report 77-169-B, 1 sheet, scale 1:1,000,000.

Coulter, H.W., et al., 1965, "Map Showing Extent of Glaciations in Alaska", U.S. Geological Survey Miscellaneous Geologic Investigations Map I-415.

Eberlein, G.D., Gassaway, J.S., and Beikman, H.M., 1977, Preliminary geologic map of central Alaska: U.S. Geological Survey Open-File Report 77-168-A, 1 sheet, scale 1:1,000,000.

Foster, H.L., 1970, "Reconnaissance geologic map of the Tanacross quadrangle, Alaska", U.S. Geological Survey Miscellaneous Investigations 593, 1 sheet, scale 1:250,000.

Foster, H.L., Keith, T.E.C., and Menzie, W.D., 1987, Geology of east-central Alaska: U.S. Geological Survey Open-File Report 87-188.

Foster, H.L., comp., 1992, Geologic map of the eastern Yukon-Tanana region, Alaska: U.S. Geological Survey Open-File Report 92-313, 26 p., 1 sheet, scale 1:500,000.

Holmes, G.W., 1965, Geologic reconnaissance along the Alaska Highway, Delta River to Tok Junction, Alaska: U.S. Geological Survey Bulletin 1181-H, p. H1-H19, 1 sheet, scale 1:125,000.

Holmes, G.W., and Foster, H.L., 1968, Geology of the Johnson River area, Alaska: U.S. Geological Survey Bulletin 1249, 49 p., 1 sheet, scale 1:63,360.

Holmes, G.W., and Pewe, 1965, T.L., Geologic map of the Mount Hayes D-3 Quadrangle, Alaska: U.S. Geological Survey Geologic Quadrangle Maps 366, 1 sheet, scale 1:63,360.

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